الجمهورية الجزائرية الديمقراطية الشعبية

People`s Democratic Republic of Algeria

Ministry of Higher Education and Scientific Research
National School of Cyber Security
Foundation Training Department

وزارة التعليم العالي والبحث العلمي
المدرسة الوطنية العليا في الأمن السيبراني
قسم التكوين القاعدي

NSCS
المدرسة الوطنية العليا في الأمن السيبراني
NATIONAL SCHOOL OF CYBERSECURITY

LEVEL : 1st Year Basic Training
SECTION / GROUP : A & B
MODULE : Electricity
FULL NAME : .....

Midterm 1 Test

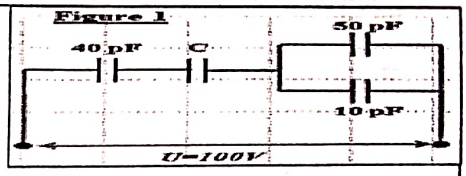
MODULE'S TEACHER : Dr. BOUCHEMHA
DATE : 24 / 11/ 2024
DURATION : 1h30
NOTE : No documents are allowed.

Exercise 1: (7pts)

1- For the circuit shown in figure 1, the total capacitance is **16 pf**. Calculate :

a- The value of the capacitance C ,**(1,25pt)**

b- The total charge and the total energy stored **(1,25pt)**

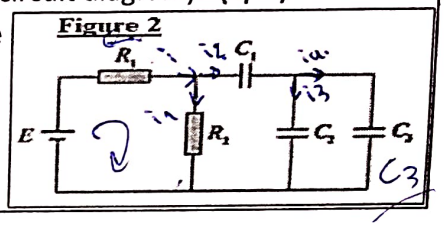


2- Let's consider the electrical circuit shown in figure 2, where $R_1=R_2=R$ and $C_1=C_2=C_3/2=C$.

a- Determine the currents in the various branches of the circuit when steady state is reached (name each of the currents flowing through the branches on the electrical circuit diagram). **(2pts)**

b- Find the equivalent capacitance C_{eq} of the combination of the three capacitors C_1 , C_2 and C_3 (Express it in terms of C). **(1pt)**

c- Determine the charge Q_1 of capacitor C_1 and voltage V_1 across its terminals. **(1.5pts)**



Exercise 2 (6pts)

1- *Calculate the equivalence resistance of circuit in figure 1 (2pts)*

2- *Calculate the current intensity in each branch of the circuit shown in figure 2.* **(4pts)**

***Note**: You must draw the circuit with all the currents and voltages through each dipole. Also indicate the direction you have chosen.*

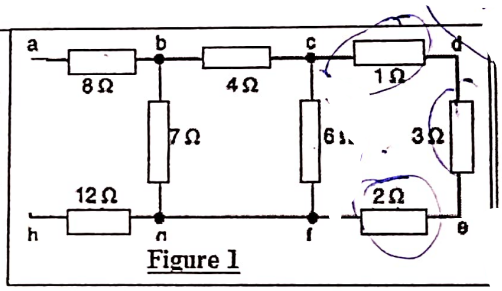


Figure 1

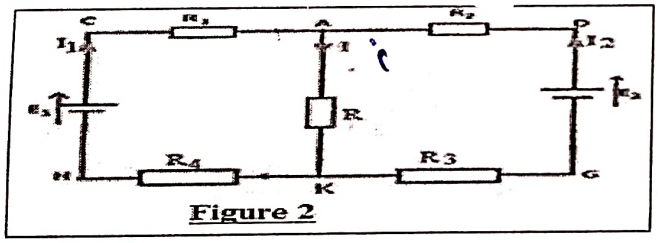


Figure 2

We give:

$$R_1 = 10k\Omega, R_2 = 5k\Omega, R = 1k\Omega$$
$$R_3 = 1\ k\Omega, R_4 = 2\ k\Omega, E_1 = E_2 = 10V$$

Exercise 3: (7pts)

1- The intensity of a uniform magnetic field is given by B = 3t−2 (Teslas). A metal frame with a surface area of 650 cm² is placed in this field, with its perpendicular angle at 50° to the field orientation.

a. Determine the rate of change of magnetic flux Φ passing through this surface (1.25pts).

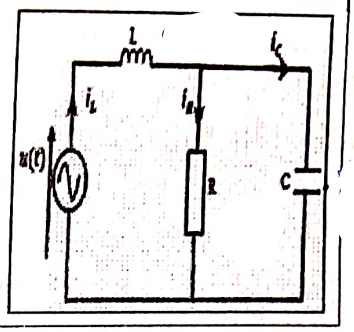
b. Determine the induced emf produced in a coil composed of 1760 rings (1pt).

2- Consider the electrical circuit shown in the figure opposite, powered by an AC source whose peak value is given by the absolute value of the emf calculated previously.

a- Determine the instantaneous voltage of AC source $u(t)$. This voltage is 110 V at the initial instant **(1pt).**

b- Calculate the induced current $i_{\square}(t)$ and give it's expression in complex form if the AC voltage is applied to a 1kΩ resistor **(1pts)**

c- Calculate the equivalent impedance of the circuit and give the magnitude and angle shift. **(2.75 pts).**



Given: L=0.3H, R=100Ω, C=50μF and f=60Hz